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**TRANSMITTAL  
FORM**

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission

57

Application Number

10/764,634

Filing Date

01/23/2004

First Named Inventor

Jerry Gene Williams

Art Unit

2877

Examiner Name

Valentin, Juan D.

Attorney Docket Number

**ENCLOSURES (Check all that apply)**

Fee Transmittal Form



Fee Attached



Amendment/Reply



After Final



Affidavits/declaration(s)



Extension of Time Request



Express Abandonment Request



Information Disclosure Statement



Certified Copy of Priority Document(s)

Reply to Missing Parts/  
Incomplete ApplicationReply to Missing Parts  
under 37 CFR 1.52 or 1.53

Drawing(s)



Licensing-related Papers



Petition

Petition to Convert to a  
Provisional Application

Power of Attorney, Revocation



Change of Correspondence Address



Terminal Disclaimer



Request for Refund



CD, Number of CD(s) 1

☐ Landscape Table on CD

Remarks



After Allowance Communication to TC

Appeal Communication to Board  
of Appeals and InterferencesAppeal Communication to TC  
(Appeal Notice, Brief, Reply Brief)

Proprietary Information



Status Letter

Other Enclosure(s) (please identify  
below):Revised:  
- claims  
- Abstract  
- Specification  
- Drawings**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT**

Firm Name

Petroleum Composites

Signature

Jerry Gene Williams

Printed name

Jerry Gene Williams

Date

3/24/2007

Reg. No.

**CERTIFICATE OF TRANSMISSION/MAILING**

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Signature

Jerry Gene Williams

Typed or printed name

Jerry Gene Williams

Date

3/26/2007

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# Petroleum Composites



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Appl. No. : 10/764,634  
Confirmation : No. 9083  
Applicant : Jerry Gene Williams  
Filed : 1/23/2004  
Examiner : Juan D. Valentin

Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

Subject: Amendment to Patent Application No. 10/764,635


Dear Mr. Valentin:

This correspondence is in response to the Notice of Non-Compliant Amendment I received from your office dated October 26, 2006. I am submitting the attached material to address the issues you have with my application. Thank you for the clarification you provided in the phone conversation of March 15, 2005. The original claims 1-13 have been deleted and new claims 14-40 inserted. The drawings are marked as replacement sheets as directed. For your convenience, I have also enclosed a clean copy of the claims.

All changes contained in the specification, claims, and drawings are for clarification purposes in response to requests from the USPTO and do not contain any new material not contained in the original patent application submitted on 1/23/2004.

For your convenience, I have also enclosed a CD of the Word files of the information contained herein. If you require additional information, please contact me.

Respectfully submitted,

  
Jerry Gene Williams

ATTACHMENTS:



# Petroleum Composites



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March 26, 2007

United States Patent and Trademark Office  
Attn: Mr. Juan D Valentin  
Examiner, Art Unit 2877  
P. O. Box 1450  
Alexandria, VA 22313-1450

**SUBJECT: Patent Application No. 10/764,634 entitled: "Performance Monitoring of Offshore Petroleum Risers Using Optical Strain Sensors"**

Dear Mr. Valentin:

I am responding to the "Office Action Summary" mailed by you on September 26, 2006 relative to the subject patent application. I take this opportunity to address the concerns you raise in your review in which you rejected all 13 claims. I have accordingly revised portions of the specification, figures and claims to address the issues you raised. According to instructions provided on the web site, I have used strike-through to indicate deletions and underlining to indicate additions. I request your review to confirm that I am now in compliance.

Considering how poorly the original patent application was written, it is quite understandable why you had difficulty understanding the essence of the invention. I am named as inventor on numerous patents in my past professional career with government and industry, however all these patents were prepared by government or industry attorneys. Now, I am a small business individual and the patent office favorably grants me the option to prepare my own patent application. As you know, a patent application is a whole new discipline with a unique vocabulary and set of rules. To help me, I purchased patent application software, but it is less than perfect. I am learning and was granted a patent last year which I prepared. Hopefully, I have learned sufficiently in the process to provide a professional response to your concerns.

It is the intent of my invention to provide a means using fiber optics technology to determine the vibration characteristics of long slender structures subjected to dynamic disturbances imposed by water or wind generated loads. I believe in order to focus on this objective and in consideration of your concerns relative to the references which you cite; I am willing to abandon certain technology addressed in my set of claims including:

1. claims related to measurement of circumferential and off-axis strains,
2. claims related to measurement of temperature,
3. claims related to measurement of strain in the end couplings.

I have therefore, canceled claims 1-13 and inserted a new set of claims 14-42. I spoke with one of your colleagues at the inventors help desk and was advised that this was the appropriate way to format my response.

I request permission to change the title of the invention from: "Performance monitoring of offshore petroleum risers using optical strain sensors" to "Dynamic Performance Monitoring of Long Slender Structures Using Optical Fiber Strain Sensors" to better reflect the essence of the invention.

### ***Priority***

This application claims priority from U.S. Provisional Patent Application No. 60/441,703, filed Jan. 23, 2003 entitled "Fiber Optics Strain Measurement On Composite Tubulars", herein incorporated by reference in the entirety.

### ***Claim Objections***

1. The grammatical errors and multiple improper antecedent basis issues you describe have been corrected.
2. Claims 9 and 10 are canceled as detailed below.

### ***Claim Rejection – 35 USC § 112***

3. Claims 1-13 are canceled and claims 14-42 have been added.

The text has been revised to address the issues described in the reviewer's response with special attention to providing proper antecedent information in the specification.

Optical Time Domain Reflectometry and Bragg diffraction grating are two independent methods for measuring strain using optical fibers and this distinction is made in the specification.

### ***Claim Rejections – 35 USC § 102***

4. Claim 11 was rejected based on previous publications or patents, as set forth in the language of 35 U.S.C. 102(b) as being anticipated by Didden et al. (USPN 6,271,766 B1)

Although Claim 11 is canceled, the topic may relate to the revised claims, so the inventor has addressed it herein. The new claims relate to a system which utilize bending strain data obtained using fiber optics technology to determine vibration characteristics of long slender structures and buckling characteristics of spoolable pipe injected into an annulus rather than to specifically claim the invention of fiber optics strain measurement methods such as Optical Time Domain Reflectometry or Bragg diffraction grating.

However, the inventor wishes to point out that the substance of Didden's et al. claims describe a fiber optics sensing system focused on the measurement of pressure and temperature, not strain. In fact, the only mention of strain in the entire patent is on page 1, line 12 where an electronic strain gage, not a fiber optics method is cited as a technology used in the oil industry. Based on omission of the use of fiber optics methods to measure strain, the inventor does not believe Didden had any intent to

measure strain with his system. Instead he provides a system for selectively recording data obtained from optical fibers as described on page 1, line 45-47 and elsewhere in the patent. For example, on page 3, line 1-7 and page 3, line 40-43; the patent identifies parameters to record as: pressure, temperature, liquid fraction, flow, acoustic, seismic, resistivity, corrosion, and pipe wall build-up. Strain measurements are specifically omitted in the claims. Claim 13 lists the sensor measurements of the patent as: pressure, temperature, liquid fraction, flow, acoustic, seismic, resistivity, corrosion, or pipe-wall build-up, but not strain. The patent claims a system which records data in a selective way to address billing only for those specific measurement services needed and recorded.

Since Didden, et. al. do not address making strain measurements, it also does not address the measurement of bending strains. The topic of strain measurements is not addressed in col. 1, lines 10-32; col. 1, lines 45-63; col. 3, lines 1-7; or col. 3, lines 29-67. Didden, et. al indicate the transmission cable can be protected from damage from operation in the marine environment (col. 3, lines 29-33) by use of a steel capillary tube.

### ***Claim Rejections – 35 USC § 103***

The inventor proposes that the revised set of claims do not violate the principles established in 35 USC § 103.

#### **Claims 1-10**

Claims 1-10 have been canceled. As discussed above, Didden et. al. does not specifically apply to the measurement of strain, bending strains or to the measurement of dynamic disturbance as detailed in the revised set of claims enclosed herein.

5. Claims 1-10 rejected under 35 U.S.C. 103(a) as being unpatentable over Didden in view of Crotearu et al. (USPN 6,550,342 B2).

Crotearu's et al. patent is for an apparatus for *varying the gain (sensitivity)* of a fiber optic sensor and includes a *circumferential strain attenuator* for this purpose. I have canceled claims related to the measurement of circumferential strain as this is not necessary for the measurement of bending strains and determination of the dynamic characteristics of a long slender structure; the intended focus of my claims. For this purpose, my patent uses longitudinal strain determined by any optical fiber method including but not limited to Optical Time Domain Reflectometry and/or Bragg diffraction gratings. The invention by Crotearu et al. addresses the measurement of the flow characteristics of a fluid in a pipeline in a non-intrusive manner [page 2, lines 7-15] and does not relate to measurement of bending strains, i.e. strain along the longitudinal axis of a long slender structure.

#### **Claims 1,7**

As discussed above Didden et. al. addresses the measurement of temperature but not strain. Claims related to temperature have been canceled. I have also cancel claims related to measurement of strain in end couplings to focus on claims related to

determining the dynamic characterization of long slender structures. As noted above Didden et. al. do not discuss using back to back strain measurements to calculate bending strains, or to measure strains in end couplings. Croteau et al. use optical fiber technology to measure circumferential strains for the purpose of measuring pressure variations within a tube, but do not discuss bending strains or measure the strains in end couplings. Croteau et al. discuss inserting the optical fiber transmission cable into a stainless steel tube for transport to the recording instrument. They do not address the bonding of the optical fiber to the structure for purposes of experiencing identical strain as that structure.

As the reviewer points out, Didden et al. did not discuss looping the optical fiber for increased sensitivity, but Croteau et al. does use *circumferential loops* [not end to end] to increase the sensitivity for making pressure measurements. The loops of Croteau et al. are a series of discrete circumferential loops as shown in Figs. 1 and 6 and described in col. 5, lines 29-44 placed in series along the length of the pipe, not a loop end to end. Although it is not essential to the principles of the patent, my revised claims use optical fiber looping along the axis of long slender structures to increase the sensitivity for making bending strain measurements used to characterize the dynamic behavior of long slender structures or to determine the buckling characteristics of spoolable pipe.

#### **Claims 2, 3, 5, and 8**

Claims 1-13 have been canceled and Claims 14-42 added. The new claims relate to a system which utilizes strain data obtained using fiber optics technology to determine vibration characteristics of long slender structures and buckling characteristics of spoolable pipe injected into an annulus rather than to specifically claim the invention of fiber optics strain measurement methods such as Optical Time Domain Reflectometry or Bragg diffraction grating.

#### **Claim 4**

Didden et al. describes inserting the optical fiber transport carrier into a stainless steel tube. My invention describes protecting the optical fiber rigidly attached to the long slender structure used to measure strain from damage by hazards imposed in the operating environment by a polymeric or elastomeric external layer. Although the system is functional without the external layer and protected to some degree by the bonding material used to attach the optical fiber to the long slender structure, the polymeric or elastomeric external layer affords additional protection and becomes integral with the strain measurement system.

#### **Claim 6**

Claims for the fiber optics connection box have been canceled.

#### **Claims 9 and 10 (appear to be identical)**

Claims 9 and 10 have been canceled. New claims do not repeat this duplication error.

As described above, Didden et al. patent is focused on the measurement of pressure and does not address measurement of strain. Claims related to temperature have been canceled and new claims do not address temperature. Strains along the longitudinal axis of a long slender structure are measured as part of a system to characterize dynamic effects in tubes, ropes and cables or the buckling response in spoolable pipe deployed into a small diameter annulus. New claims do not address the measurement of circumferential strains. Claims related to the end coupling have been canceled and new claims do not address this topic. As discussed above Didden et al. (col. 1, lines 10-32, col. 1, lines 45-63, col 3, lines 1-7, col 3, lines 29-67) do not address measurement of strain or a system for measuring bending strains.

In their patent, Croteau et al. discusses using multiple circumferential loops of an optical fiber to increase the sensitivity for making pressure measurements. Lengthening the gage length by looping the optical fiber back and forth along the longitudinal axis of a long slender structure as part of a system to measure bending strains is not disclosed in Didden or Croteau.

It is recognized that Optical Time Domain Reflectometry (OTDR) and Bragg diffraction grating as well as other optical fiber strain measurement methods are established technology and no claim is made thereof. These optical fiber measurement instrumentation tools are used as part of a system to characterize dynamic behavior of long slender structures and the bending and buckling characteristics of spoolable pipe deployed into a small diameter annulus.

See discussion above related to Claim 4 relative to use of polymeric protective outer layer. Discussion give above Claims related to the end coupling have been canceled and new claims do not address this topic.

6. Claims 12 and 13 rejected under 35 U.S.C. 103(a) as being unpatentable over Didden in view of Zimmerman et al. (USPN 5,649,035)

Zimmerman et al. describe a fiber optics based strain gage patch which measures the local strain response of a structure. The strain gage is constructed of loops of an optical fiber to increase the strain measurement sensitivity and uses OTDR instrumentation to measure the strain. The application for the technology cited on page 6, lines 2-5 is to monitor the local strain in a structure like a bridge. My invention uses fiber optics technology to make strain measurements but the application and claims are totally different. My invention uses fiber optics technology to measures strain and interprets the data for the purpose of determining the dynamic characteristics of long slender structures or the bending/buckling characteristics of spoolable pipe inserted into a small diameter annulus.

#### **Discussion of New Claims 14-42**

As discussed above, claims 1-13 are canceled and new claims 14-42 have been inserted. It is the purpose of this section to establish that these new claims are not based on new material, but were ideas inherent in the patent application submitted on January 23, 2004.

The first essential element of my invention is the measurement of bending strain using optical fiber technology for the purpose of determining the dynamic characteristics of long slender structures subjected to loads imposed by wind or water disturbances. Long slender structures include marine risers and large ropes and cables.

The second essential element of my invention is to use bending strain measurements obtained using optical fiber technology to determine the state of buckling of spoolable pipe inserted into a small diameter annulus and further to use such information to prevent the state of permanent lock-up when the friction force between the annulus and the buckled spoolable pipe is sufficiently great to prevent retraction of the spoolable pipe from the annulus.

I use fiber optics strain measurement methods to achieve the above and do not claim the invention of Optical Time Domain Reflectometry, Optical Frequency Domain Reflectometry, Bragg diffraction, or other strain measurement methods themselves. I have also deleted many of the peripheral related claims to focus on the two essential themes. I have refined the language in the specification to better explain the details. I refer to the original specification to illustrate that the claims are related to material in the original specification and is not new material.

As noted above, I do not claim fiber optics methods themselves, but use them to determine bending strain and interpret bending strain measurements to determine dynamic characteristics of long slender structures and buckling characteristics of spoolable pipe. Vortex Induced Vibrations is representative of this type of dynamic disturbance and is highlighted for illustration. The use of fiber optics time of flight methods such as Optical Time Domain Reflectometry, and other methods including Optical Frequency Domain Reflectometry, and Bragg diffraction are discussed throughout the original specification and specifically in claims 2, 3, 5, 8, 9, 10, 11, 12 and 13. The revised specification better explains how these methods are used to determine the strain measurements essential to the invention. VIV is discussed throughout the original specification and specifically in claims 1, 9, and 10. Measurement of axial strains is fundamental to measuring bending strains and is highlighted throughout the specification and specifically in claims 1, 2, 7, 8, 9, 10, 11 and 12. Specific references to bending strains are contained in the original abstract and in the specification in paragraphs 8, 22, 23, 29, 37, and 57 and in claims 1, 7, 9 and 10. Use of multiple sets of optical fibers to measure axial strains placed strategically around the circumference for the purpose of capturing the maximum bending strain and thus to characterize the dynamic mode shape, amplitude, and frequency is contained in the original specification in paragraphs 37 and 46 and claims 7, 9, and 10. References to the application to marine tubulars including risers is discussed throughout the original specification and specifically in claims 1, 3, 4, 5, 6, 7 and 8. References to the application to spoolable pipe are contained in the original specification including measurement of axial strain in paragraphs 23 and 41 and in claims 1, 11, 12 and 13 and the use of bending strain measurements on spoolable pipe to determine the buckling and lock-up is implied in paragraphs 1, 23, and 41. With regard to measurement of the large strains characteristic of composite and spoolable pipe, plastic optical fibers exhibiting high strain to failure relative to glass optical fibers is discussed in the specification in paragraphs 11,

14, 23, 29, 35, and 41. A rope or cable is a long slender structure and the application of the fiber optics technology described to measure the dynamic response to wind and water imposed loads is identical to that described in the original specification for strain measurements risers contained in claim 1 and the implied application to ropes in paragraph 55. The term "long slender structure" is a common term used in the engineering community and is used herein to better summarize the applications to which the invention applies.

**MPEP 707.07(j)**

If the Examiner believes that there is patentable subject matter disclosed in the present application, but he does not feel that the present claims are technically adequate, he is respectfully requested to write acceptable claims pursuant to MPEP 707.07(j), a copy of which is copied below.

**707.07(j)**

**State When Claims Are Allowable**

**Inventor Filed Applications**

When, during the examination of a pro se case, it becomes apparent to the examiner that there is patentable subject matter disclosed in the application, the examiner shall draft one or more claims for the applicant and indicate in his or her action that such claims would be allowed if incorporated in the application by amendment.

This practice will expedite prosecution and offer a service to individual inventors not represented by a registered patent attorney or agent. Although this practice may be desirable and is permissible in any case where deemed appropriate by the examiner, it will be expected to be applied in all cases where it is apparent that the applicant is unfamiliar with the proper preparation and prosecution of patent applications.

As indicated above, I believe the method described in the patent application for determining the dynamic response of long slender structures and the buckling response of spoolable pipe inserted into a small diameter annulus and associated claims is useful and novel and is not obvious based on prior art. I appreciate the professional manner in which the USPTO reviews patent applications submitted to it and look forward to hearing from you after you review my response to your questions.

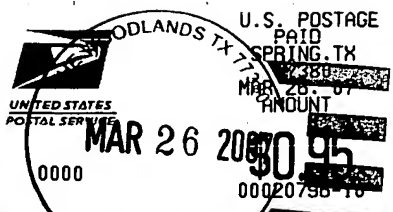
Sincerely,



Jerry G. Williams, Ph.D., P.E.

**Enclosures:**

1. Revised Patent description, claims, abstract and figures.
2. Form PTO/SB/22 credit card authorization for \$510 to cover the 3 month time extension for this response.
3. CD containing Word file of item 1.



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